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Optical spectra in the region of exciton resonances in quantum wells and quantum dots of $In_{0.3}Ga_{0.7}As/GaAs$ heterostructures

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Abstract

The transparency, reflection and luminescence spectra of $In_{0.3}Ga_{0.7}As$ structures with 8nm thickness and quantum wells limited by the barrier layer GaAs of a 9nm (upper layer) and 100nm (bottom layer) thickness had been studied in the region of photon energy 0.5–1.6eV. Lines associated with the transitions hh,lh1-e1(1s,2s,3s), hh2,lh2-e2(1s,2s,3s), hh1,lh1-e2(1s) and hh3,lh3-e3(1s) had been revealed in reflection spectra. The shapes of the reflection and transparency lines had been calculated using a single oscillator model of dispersion relations and the Kramers–Kronig integrals. The binding energy of hh,lh1-e1 excitons, the effective mass m_{hh}^* and m_{lh}^* and the damping factor for the optical transitions to QW and QD had been determined. The lifetime of charge carriers on quantum dots varies in the range of 0.04–0.1ps, while the radiative lifetime of excitons in quantum wells in the considered structure is around 2ps.